

PATENT SPECIFICATION

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(54) SLIDE PROJECTOR FOR AUTOMATIC AND CONTINUOUS REPEATED SHOWING OF SLIDES IN A MAGAZINE

(71) We, AGFA-GEVAERT AKTIENGESSELLSCHAFT, a body corporate recognised under German Law, of Leverkusen, Germany, do hereby declare the invention for

5 which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a slide projector
10 for automatic and continuous repeated showing of slides in a magazine, wherein the magazine is advanced intermittently for each slide by means of a main drive motor for showing and the slide is guided out
15 of the magazine into a projection position and back again by means of a reciprocating slider driven by the main drive motor, means being provided for returning the magazine to its initial position in order to
20 repeat the showing.

It has previously been proposed to provide switching means for reversing the direction of rotation of the drive motor which are capable of being switched by way of
25 projections attached to or formed on the magazine ends. No matter whether it is filled to the last compartment with slides or not, the magazine is transported forwards right up to the end position before
30 being returned to its initial position. In the case of magazines which are not completely filled, this produces useless idling, which causes the automatic return system to seem a disadvantage. For this reason,
35 it has previously been proposed to provide control plates which can be inserted in the magazine in front of the first and after the last slide to be shown and by way of which the switching means can be controlled. This arrangement is inconvenient,
40 in that, for repeated showing of the slide series, the control plates must first be inserted in the magazine at the places mentioned. Furthermore, accessories such as
45 these control plates are very easily lost.

[Price 25p]

It is an object of the invention to overcome the above-mentioned disadvantages by providing a slide projector in which the automatic repetition of the showing of a series of slides, which for example may not
50 completely fill the magazine, is possible without idle running, and in which no control plates have to be used in order to allow such a series of slides actually to be shown repeatedly without idle running. 55

The present invention provides a slide projector for showing automatically and repeatedly a series of slides arranged in a magazine, which includes main drive means for advancing the magazine stepwise
60 to bring each slide in turn into a waiting position, reciprocatory means for moving each slide in turn from the waiting position into the projection position and for returning the slide to the magazine after the
65 desired projection time, return drive means for returning the magazine to its initial position, detector means responsive to the presence of slides in the magazine and arranged to sense when there is no further
70 slide to be advanced to the waiting position, control means responsive to the said detector means and arranged to arrest the operation of the reciprocatory means and
75 actuate the return drive means when the last slide has been displayed, and switch means arranged to terminate the return movement when the magazine reaches its initial position and to initiate a further
80 showing of the set of slides.

The present invention also provides a slide projector for showing automatically and repeatedly a series of slides arranged in a magazine, which includes main drive means for advancing the magazine step-
85 wise to bring each slide in turn into a waiting position, reciprocatory means for moving each slide in turn from the waiting position into the projection position and for returning the slide to the magazine 90

after the desired projection time, the said reciprocatory means being operated by the main drive means, and return drive means for returning the magazine to its initial position after projection of the last slide of the series, electrical control means having two switched states, in the first of which operation of the return drive means is prevented and the main drive means is operative by means of an over-ride switch which is switched operative and in the second of which operation of the return drive means is permitted and the main drive means is inoperative by means of the over-ride switch which is switched to inoperative, detector means responsive to the presence of slides in the magazine and arranged to sense when there is no further slide to be advanced to the waiting position and to prepare switching of the electrical control means into the second switched state on advancement of the last slide in the series so that, when a two-way switch is switched into a position which causes switching of the electrical control means into the second position, the return movement of the magazine is initiated, and an end switch arranged to terminate the return movement when the magazine reaches its initial position and to cause the electrical control means to revert to the said first switched state to render the over-ride switch operative and initiate a further showing of the series of slides.

The present invention further provides a slide projector for showing automatically and repeatedly a series of slides arranged in a magazine, which includes main drive means for advancing the magazine stepwise to bring each slide in turn into a waiting position, reciprocatory means for moving each slide in turn from the waiting position into the projection position and for returning the slide to the magazine after the desired projection time, the said reciprocatory means being operated by the main drive means, and return drive means for returning the magazine to its initial position after projection of the last slide of the series, there being provided a two-way switch, which, when each slide is returned to the magazine after projection, is switched from a first position in which it allows the main drive means to operate the reciprocatory means to a second position in which it disconnects the main drive means and permits operation of the return drive means, the two-way switch being returned to the said first position before projection of the next slide, an over-ride switch arranged to maintain operative the main drive means when two-way switch is in the said second position, electrical control means having two switched states, in the first of which operation of the return

drive means is prevented and the over-ride switch is rendered operative and in the second of which operation of the return drive means is permitted and the over-ride switch is rendered inoperative, detector means responsive to the presence of slides in the magazine and arranged to sense when there is no further slide to be advanced to the waiting position and to cause switching of the electrical control means into the second switched state on advancement of the last slide in the series so that, when the two-way switch is switched into its second position, the return movement of the magazine is initiated, and an end switch arranged to terminate the return movement when the magazine reaches its initial position and to cause the electrical control means to revert to the said first switched state to render the over-ride switch operative and initiate a further showing of the series of slides.

The electrical control means itself may comprise a transistor amplifier or, preferably, a thyristor. When using a thyristor as the control means, the thyristor can be controlled by means of the slide detector means. It will be appreciated that, when the electrical control means comprises a thyristor, the slide detector means need only apply a voltage to the control electrode for a sufficient period of time to render the thyristor conductive, for the thyristor will thereafter remain conductive, irrespective of whether or not a voltage is applied to the control electrode. It follows that, when a thyristor is used, the slide detector means may comprise a switch that is arranged to close on advancement of the last slide, and thereafter to open on detecting the first returning slide.

On the other hand, when a transistor amplifier is used, means should be provided, for example, relay means, for ensuring that the required control voltage is applied to the amplifier until the return movement is complete.

The slide detector means may comprise a detector switch by means of which the control electrode of the thyristor can be connected to a voltage divider arranged to provide the required voltage to render the thyristor conductive. The detector switch preferably has a flexible contact arm which can be held in the open position by means of the next slide which is to be advanced to the waiting position.

Instead, the slide detector means may comprise a detector switch, closure of which causes switching of the electrical control means into the said second switched state, a movable feeler lever for effecting closure of the said switch, and means for resiliently urging the lever towards the position in which it closes the switch, the

lever being arranged to be prevented from closing the switch by the next slide to be advanced to the waiting position, and means being provided for holding the lever out of contact with the slides during advancement of the magazine.

The over-ride switch may comprise a transistor, the base of which is connected to the output circuit of the electrical control means and the emitter of which is connected to a magnetic coupling for enabling the main drive means to operate the guide member and to advance the magazine. The transistor can be rendered non-conductive by means of the detector switch of the slide detector means. For this purpose, in one switching state of the electrical control means a contact electrode of the thyristor can be connected to the base of the transistor in order to switch off the transistor.

The two-way switch is preferably operated by the guide member, in the reverse position of the guide member on the magazine side.

The end switch is preferably arranged to be operated by the magazine as it returns to its initial position, to terminate the return movement and cause the electrical control means to revert to the said first switched state, that is to say, to the state in which magazine advancement and operation of the guide member is permitted.

Another form of slide detector means comprises means for directing a beam of light onto the slide in the waiting position, and a photo-sensitive device arranged to be illuminated by light reflected from the said slide only when there is no slide awaiting advancement and to cause switching of the electrical control means into the said second switched state in response to the said illumination.

A slide projector constructed in accordance with the invention, and three forms of slide detector means according to the invention, will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 shows a diagrammatic, perspective view of the slide projector, including the first form of slide detector means;

Fig. 2 shows a circuit diagram of the slide projector;

Fig. 3 shows the second form of slide detector means; and

Fig. 4 shows the third form of slide detector means.

The construction and method of operation of the slide projector according to the invention will be explained with reference to Figs. 1 and 2, reference being made to Fig. 1 for the mechanical control and to Fig. 2 for the electrical circuitry.

A magazine 1, which may be completely or, as shown in Fig. 1, partly filled with slides, is inserted in a magazine guide 3 provided in the housing of the slide projector (not shown). The magazine 1 is advanced stepwise for each slide in the direction of the arrow 6 by way of known driving means (not shown), connected by way of a magnetic coupling 4 to a main drive motor 5.

For moving a slide 2 from the magazine in the direction of the arrow 11 into the projection position, there is provided a reciprocatory member 10. The reciprocal motion required for this purpose is imparted to the member 10 by means of a control disc 7 and a slider 9. The control disc 7 is driven by the main motor 5 by way of a magnetic coupling 4. The switching cycle and the duration of projection are determined by the alternate closing and opening of the main switch 8 by means of a tripping cam 7a of the control disc 7 in conjunction with a time switch 12 which is in parallel with the main switch 8 and is controlled by means of a cam disc 14 driven by a timing motor 13. When a slide reaches the projection position, the cam 7a causes the coupling 4 to disconnect opens the switch 8 and so uncouples the motor 5 from the disc 7. After the desired projection time, the rotating cam 14 reaches a position in which it closes the switch 12, so re-energising the coupling 4 to enable the control disc 7 to resume its rotary movement.

For the automatic return of the magazine 1 (which may for example not be filled right to the last compartment) after projection of the last slide 2', there is provided a return motor 15 which, in operation, drives a two-toothed pinion 16 which engages mechanically with the lower toothed portion of the edge 1a of the magazine. The return motor 15 can be connected by means of a contact 17 of a two-way switch 17, 18, 35 to the positive pole of the current supply. The return motor 15 can be connected to the negative pole of the current supply by way of the contact 19 of a further switching device in the form of an end switch 19, 20, 36, by way of the contact 21 of a repeat switch 21, 22 and the contact electrodes 24 and 25 of a thyristor 23 that is provided as electrical control means. The control electrode 26 of the thyristor 23 is connected to a voltage divider which comprises resistors 27, 28 and 29. The control electrode 26 of the thyristor 23 can be connected to the section 27, 28 of the voltage divider by way of the contact 31 of a detector switch 31, 32 which is arranged to be closed on advancement of the last slide to the waiting position. For this purpose

pose, the detector switch 31, 32 is provided with a flexible contact arm 32 that is biased into contact with the next slide to be advanced into the waiting position.

- 5 Connected to the centre tapping of the resistors 27, 28 is the base of a NPN-transistor 33, which serves as a switching device to couple up the main drive motor 5, and which can be connected to the contact electrode 24 of the thyristor 23 by way of the contacts 19 and 21 of the switches 19, 20 and 21, 22, respectively. The collector of the transistor 33 is connected to the positive pole of the current supply, and the emitter of the transistor 33 is connected to the magnet 4 of the magnetic coupling of the main drive motor 5.

- 10 In addition, the magnet 4 can be connected directly to the positive pole of the current supply by way of the contact 35 of the two-way switch 17, 18, 35. The return motor 15 can be short-circuited by way of the contact 36 of the end switch 19, 20, 36. A capacitor 34 is provided in order to prevent the induced e.m.f. resulting from the de-energising the magnet 4 from damaging the transistor 33.

- 15 The resilient contact arm 32 of the feeler switch 31, 32 is so arranged in the region of movement of the slide 2 that at each forward transport step it comes to rest on the top of the next slide to be advanced, and the detector switch 31, 32 is opened during the forward transport of the magazine 1 until the transport movement for the last slide 2' to be projected. The reciprocatory member 10 is formed with an arm 10a which at the point of reversal of the guide member 10 on the magazine side moves the contact arm 18 of the two-way switch 17, 18, 35 from the contact 35 over to the contact 17. The arm 10a releases the contact arm 18 from the contact 17 on removing the next slide from the waiting position. The contact arm 20 of the end switch 19, 20, 36 rests on the smooth upper surface of the edge 1a of the magazine 1 except that, when the first slide for projection is in the plane of the reciprocatory member 10, the contact arm does not touch the edge 1a of the magazine 1 and therefore rests against the contact 36, thereby short-circuiting the return motor 15. The slide projector has on it a repeat switch knob 37, the actuation of which allows the contact arm 22 to close the contact 21 of the repeat switch 21, 22 to permit operation of the return motor.

- 20 The method of operation of the slide projector shown in Figs. 1 and 2 is as follows:

- 25 The magazine 1 is inserted sufficiently far into the magazine guide 3 that the first slide 2 which is to be projected is in the plane of the reciprocatory mem-

ber 10; the contact arm 20 of the end switch 19, 20, 36 then rests against the contact 36. For automatic repetition of the showing of the series of slides 2 arranged in the magazine 1, the contact 21 is closed by way of the contact arm 22 of the repeat switch 21, 22 by actuation of the repeat switch knob 37. The contact arm 18 of the two-way switch 17, 18, 35 rests against the contact 35, so that by way of the latter, with the switch 8 closed, the magnet 4 of the magnetic coupling is supplied with current. The main drive motor 5 is therefore coupled by way of the engaged magnetic coupling 4 to the control disc 7 and drives the latter. The reciprocatory member 10, controlled by means of the control disc 7, guides the slide into the projection position for the duration of the showing time determined by means of the time-switch 12, 13, 14. After projection has taken place, the slide 2 is guided back into the magazine 1 by means of the member 10. At the point of reversal on the magazine side, that is to say, when the slide is returned to the magazine, the arm 10a of the member 10 moves the contact arm 18 of the two-way switch 17, 18, 35 from the contact 35 over to the contact 17. This has no effect on the return motor 15, as long as the detector switch 31, 32 is held open by the next slide for projection, so preventing the thyristor 23 from becoming conductive. Although the coupling 4 receives no current by way of the switch 17, 18, 35 when the arm 18 rests against the contact 17 the magnet 4 of the magnetic coupling receives current at the moment of reversal of the guide member 10 by way of the collector/emitter circuit of the transistor 33, the base of which is connected to the positive potential. The magazine 1 is now advanced by one slide. This known process is repeated until the penultimate slide is guided back into the magazine 1 after showing has taken place.

When the magazine 1 is advanced so that the last slide 2' of the series arrives within the range of the movement of the reciprocatory member 10 ready for showing, the resilient contact arm 32 of the detector switch 31, 32 falls away from this slide 2' and closes the contact 31, whereupon the control electrode 26 of the thyristor 23 is connected to a voltage determined by the resistance values of the resistors 27, 28, 29, which form a voltage divider. This voltage is such that the thyristor 23 becomes preparatorily conductive. In addition, the positive voltage potential at the base of the transistor 33 falls, in the voltage dividing ratio of the resistors 27, 28, 29, to such a degree that the transistor 33 becomes blocked. During the transport, showing and return transport of

the last slide 2', the arm 18 of the switch 17, 18, 35 rests against the contact 35, so that the magnet 4 of the magnetic coupling is supplied with current by way of the aforesaid contact. When the last slide 2' is returned to the magazine 1, however, the reciprocatory member 10 has reached its point of reversal on the magazine side, and the contact arm 18 of the two-way switch 17, 18, 35 is therefore moved by the arm 10a from the contact 35 to the contact 17. As the transistor 33 is blocked, no current can reach the magnetic coupling 4. With the switch 17, 18, 35 in the 17-18 position, the return motor is connected to the positive pole of the current source and, because the contacts 19 and 21 of the switches 19, 20 and 21, 22 are closed and because the thyristor 23 has been rendered conductive by closure of the detector switch 31, 32, the return motor 15 starts up and the magazine 1 is transported back in the direction of the arrow 38. The last slide 2' which has been projected, lifts the contact arm 32 of the detector switch 31, 32 away from the contact 31 during the first step of the return movement. Since the contact electrode 24 of the thyristor 23 is connected to the base of the transistor 33, the latter still remains blocked so that still no current reaches the coupling 4. When the magazine 1 has reached its initial position, in which the first slide 2 of the series is in the plane of the guide member 10, the contact arm 20 of the end switch 19, 20, 36 drops away from the upper surface of the edge 1a of the magazine 1, so that the contact 19 is opened and the contact 36 is closed. The return motor 15 is switched off and short-circuited. The last precaution mentioned prevents the return motor 15 from over-running and so ensures that the magazine 1 is not brought back beyond the initial position. The two-toothed pinion 16 serves the same purpose if there is any slight running-on of the return motor 15. The return motor 15 is switched off by means of the end switch 19, 20, 36 in such a way that the two-toothed pinion 16 is disengaged from the toothed edge 1a of the magazine 1. The thyristor 23 returns to its non-conductive state.

With the switches 31, 32 and 19, 20 opened, the base of the transistor 33 is again connected to the positive potential of the current source and the transistor 33 is thus conductive. By way of the latter, the magnet 4 of the magnetic coupling is supplied with current so that the main drive motor 5 is again coupled to the control disc 7. The control disc 7 which is thereby driven again, in turn drives the reciprocatory member 10, so that the first slide to be projected for the second

time is brought into the projection position. The arm 10a of the reciprocatory member 10 liberates the contact arm 18 of the two-way switch 17, 18, 35, so that the latter closes the contact 35 and the magnet 4 of the magnetic coupling is again supplied with current by way of the contact 35. The second showing of the series of slides then proceeds in the same way as the first showing.

By means of the slide projector described, an automatically repeated showing of a series of slides which does not completely fill the magazine is possible without idle running, since the slides are sensed directly by means of the detector device 31, 32 and thus the return of the magazine is initiated when no further slide remains to be projected.

Referring now to Fig. 3, the contact arm 32 of the detector switch 31, 32 can be actuated by means of a feeler lever 39. The feeler lever 39 is guided along pin/slot guides 40, 41 and is pulled by a spring 42 against the next slide 2 to be projected advanced to the waiting position. In order to guide the feeler lever 39 out of reach of the magazine 1 during advancement thereof, there is provided a lever 44, which is rotatably mounted on a pin 43 and engages by means of a pin 45 in a slot 46 formed in the feeler lever 39. The slot 46 is normal to the direction of motion of the lever 39.

In the reversal position of the guide member 10 on the magazine side, the slider 9 (by means of which the necessary reciprocal motion is transmitted from the disc 7 to the guide member 10) abuts the lever 44 and rotates it in a clockwise direction, so that the feeler lever 39 is pulled out of the range movement of the magazine 1 against the action of the spring 42. If, on being subsequently released by the slider 9, the feeler lever 39 does not meet a further slide 2', it can close the contact 31 of the feeler switch 31, 32 to actuate the thyristor 23.

Referring to Fig. 4, the feeler switch 31, 32 may be replaced by a photo-resistor 47. A lamp 48 sends a beam 50 as a light signal through a collecting lens 49 onto the slides 2. The relative orientation of the lamp 48 and the photo-resistor 47 is such that only the last slide 2' brought back into the magazine from the projection position deflects a reflected part beam 50' of the light beam 50 through the collecting lens 51 onto the photo-resistor 47. The resistance of the photo-resistor 47 then drops so that the voltage necessary to trigger the thyristor 23 is applied to its control electrode 26. The thyristor 23 is therefore rendered effective in preparation for the return movement of the magazine.

WHAT WE CLAIM IS:—

1. A slide projector for showing automatically and repeatedly a series of slides arranged in a magazine, which includes
 5 main drive means for advancing the magazine stepwise to bring each slide in turn into a waiting position, reciprocatory means for moving each slide in turn from the waiting position into the
 10 projection position and for returning the slide to the magazine after the desired projection time, return drive means for returning the magazine to its initial position, detector means responsive to the presence
 15 of slides in the magazine and arranged to sense when there is no further slide to be advanced to the waiting position, control means responsive to the said detector means and arranged to arrest the operation
 20 of the reciprocatory means and actuate the return drive means when the last slide has been displayed, and switch means arranged to terminate the return movement when the magazine reaches its initial position
 25 and to initiate a further showing of the set of slides.

2. A slide projector as claimed in claim 1, wherein the reciprocatory means is operated by the main drive means.

3. A slide projector as claimed in claim 2, wherein the control means includes an electrical control device having two
 30 switched states, in the first of which operation of the return drive means is prevented and the main drive means is operative by means of an over-ride switch which is
 35 switched operative and in the second of which operation of the return drive means is permitted and the main drive means is inoperative by means of the over-ride switch which is switched to inoperative, wherein the detector means is
 40 arranged to prepare switching of the electrical control device into the second switched state on advancement of the last slide in the series so that, when a two-way switch is switched into a position which
 45 causes switching of the electrical control device into the second position, the return movement is initiated, and wherein the said switch means comprises an end switch which is arranged to cause the electrical
 50 control device to revert to its said first switched state when the magazine reaches its initial position to render the over-ride switch operative and initiate a further showing of the set of slides.

4. A slide projector as claimed in claim 2, wherein the control means includes a
 60 two-way switch, which, when each slide is returned to the magazine after projection, is switched from a first position in which it is conductive to allow operation of the main drive means and prevents
 65 operation of the return drive means to a

second position in which it permits operation of the return drive means, the two-way switch being returned to the said first position before projection of the next slide, and an electrical control device having two
 70 switched states, in the first of which operation of the return drive means is prevented and an over-ride switch is conductive to allow operation of the main drive means and in the second of which operation of
 75 the return drive means is permitted and the over-ride switch is rendered non-conductive, the detector means being arranged to cause switching of the electrical control device into the second switched state on
 80 advancement of the last slide in the series so that, when the two-way switch is switched into its second position after projection of the last slide, the return movement of the magazine is initiated, and
 85 wherein the said switch means comprises an end switch arranged to cause the electrical control device to revert to its first switched state when the magazine reaches its initial position to render the over-ride
 90 switch conductive and initiate a further showing of the set of slides.

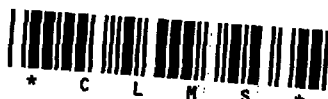
5. A slide projector as claimed in claim 3 or claim 4, wherein the electrical control device comprises a thyristor.

6. A slide projector as claimed in claim 3 or claim 4, wherein the electrical control device comprises a transistor amplifier.

7. A slide projector as claimed in any one of claims 3 to 6, wherein the slide
 100 detector means comprises a detector switch, closure of which causes switching of the electrical control device into the said second switched state, the switch having a flexible closure arm that is arranged to be
 105 held open by the next slide to be advanced to the waiting position, and to close the switch on advancement of the last slide to the waiting position.

8. A slide projector as claimed in any one of claims 3 to 6, wherein the slide
 110 detector means comprises a detector switch, closure of which causes switching of the electrical control device into the said second switched state, a movable feeler lever for
 115 effecting closure of the said switch, and means for resiliently urging the lever towards the position in which it closes the switch, the lever being arranged to be prevented from closing the switch by the next
 120 slide to be advanced to the waiting position, and means being provided for holding the lever out of contact with the slides during advancement of the magazine.

9. A slide projector as claimed in any one of claims 3 to 6, wherein the slide
 125 detector means comprises means for directing a beam of light onto the slide in the waiting position, and a photo-sensitive device arranged to be illuminated by light
 130



reflected from the said slide only when there is no slide awaiting advancement and to cause switching of the electrical control device into the said second switched state in response to the said illumination.

10. A slide projector as claimed in any one of claims 7 to 9, wherein the electrical control device is a thyristor and wherein closure of the detector switch or illumination of the photo-sensitive device, as the case may be, causes the control electrode of the thyristor to be connected to a voltage divider to render the thyristor conductive.

11. A slide projector as claimed in any one of claims 3 to 10, wherein the two-way switch is operated by the guide member.

12. A slide projector as claimed in any one of claims 3 to 11, wherein the override switch comprises a transistor, the base of which is connected in the output circuit of the electrical control device, and the emitter of which is connected to magnetic coupling means for enabling the main drive means to operate the reciprocatory means and to advance the magazine.

13. A slide projector as claimed in claim 12, wherein the transistor can be rendered non-conductive when the slide detector means causes switching of the electrical control device into the said second switched state.

14. A slide projector as claimed in claim 10, wherein, in order to render the transistor non-conductive, a contact elec-

trode of the electrical control device is connected to the base thereof.

15. A slide projector as claimed in any one of claims 3 to 14, wherein the end switch is arranged to be operated by the magazine as it returns to its initial position, to terminate the return movement and cause the electrical control device to revert to the said first switched state.

16. A slide projector as claimed in any one of claims 1 to 15, wherein the return drive means comprises a two-toothed pinion which is arranged to be rotated by a drive motor and which, in operation of the drive motor, engages a rack provided on one side of the magazine.

17. A slide projector constructed substantially as hereinbefore described with reference to, and as shown in, Figs. 1 and 2 of the accompanying drawings.

18. A slide projector as claimed in claim 17, modified substantially as hereinbefore described with reference to, and as shown in, Fig. 3 or Fig. 4 of the accompanying drawings.

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